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## PHYS 211: Problem Set 5

June 20, 2012

1. A small stone with mass  $m$  is attached to a spring with spring constant  $k$ . The mass is now swung in a horizontal circle. Ignore gravity. If the natural length of the spring is  $l$ , what is the extension produced when the speed of the stone is  $v$ ?
2. A block of mass  $m$  sits on a frictionless wedge of angle  $\theta$ . The block is attached to a spring (constant  $k$ ), one end of which is tied to the top end of the wedge. What is the natural frequency of oscillations of the block? Draw a clear picture and show all the forces.
3. A ball of mass 100g is fired from a spring loaded cannon. If the cannon is pointed at an angle of  $30^\circ$ , and the spring is initially compressed by 5cm. find the maximum height that the ball reaches when it is fired, and how far from the canon it lands. The spring constant is 100N/m.
4. A shuttle is in orbit around the earth near the earths surface. From this orbit, the shuttle uses additional boosters to change its orbit by increasing its height above the earth by 100km. How much energy was burnt by the boosters to put the shuttle in the new orbit? Assume all orbits are circular.
5. Three point masses each of 1kg are at the corners of an equilateral triangle of side 1m. Where would you place a fourth mass such that it experiences no force? I now change one of corner masses to 2kg. Where would you now place a fourth mass such that it experiences no force? Draw pictures to understand the problem.